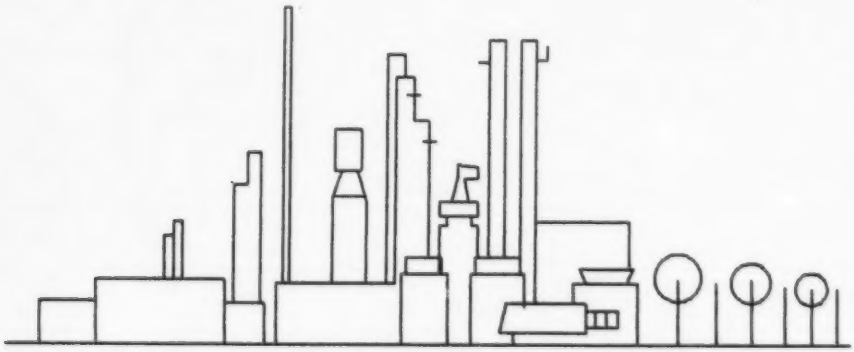
City of Scarborough

GEOGRAPHIC INFORMATION SYSTEM
CADASTRAL DATABASE REPORT



Prepared by:

R. Sussman

G. Bloom

B. Pilkington

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1.0 EXECUTIVE SUMMARY

Over a three-year period ending in December 1989, a number of studies demonstrated the feasibility, practicality and extent to which a Geographic Information System (GIS) could be used within the City of Scarborough. Council, in the 1990 Budget, established the financial basis for a GIS program and, in April 1990, an overall GIS Conceptual Data Model was developed. This Model identified the need to create a Cadastral Database as one of four GIS databases. These four databases, in turn, would be part of thirteen corporate databases, all of which would be required, in some cases, to satisfy requests for GIS information.

The Cadastral Database project reviewed information previously collected on user requirements, produced Data-Relationship Models and compared the Models to MTIS-II, the Metro model. The Study concluded that the business functions of the regional municipality were different from the business functions of the City of Scarborough and that the respective Data Models reflected the GIS needs of each corporation. Although the data elements identified in both models were similar, some modification would be required to adapt one of the systems to suit both sets of needs. The most obvious difference was that while Scarborough's GIS Cadastral information was generated as a by-product of day-to-day activities, MTIS-II represented a specific collection of, or access to, data for query and analysis purposes. The most significant technical difference was Scarborough's intended emphasis on complete Cadastral mapping rather than basing the program on a single-line street network. Although Metro did state its willingness to accommodate this and other variations, the modeling would have to be expanded to include complete Cadastral fabric and the associated physical design would have to be initiated.

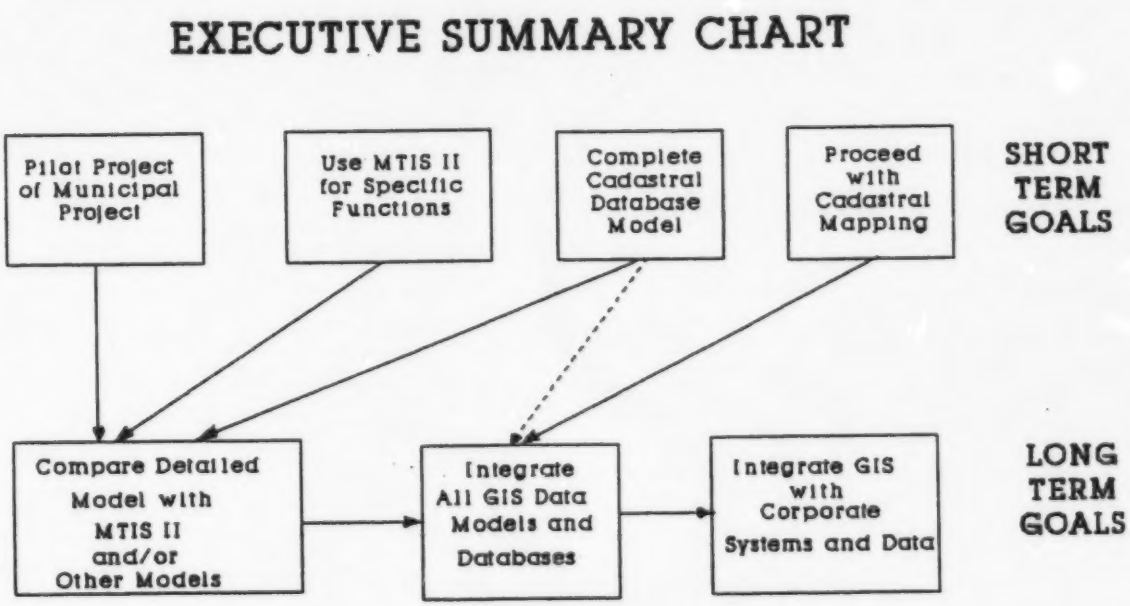
This Report recommends that Scarborough proceed with the following short-term and long-term actions:

.1 Continue modeling the Cadastral Database to the Functional and Preliminary Physical level;
.2 Obtain access to MTIS-II in order to allow users to have and experience an active GIS tool;
.3 Create a Pilot Project for the Buildings Department Information Counter using software custom-created elsewhere;
.4 Proceed with Cadastral mapping;
.5 Compare a more detailed Database Model with MTIS-II and other systems;
.6 Integrate the City's four GIS Data Models and Databases; and,
.7 Integrate GIS generally with the City's corporate systems and data.

This Report summarizes the activities of the task force over the last three months, lays a clear development program for our GIS activities, compares Scarborough's needs to Metro's Model and recommends alternative courses of action.

The Chart below summarizes these recommendations.

1.1 Executive Summary Chart


EXECUTIVE SUMMARY CHART
Pilot Project of Municipal Project
Use MTIS II for Specific Functions
Complete Cadastral Database Model
Proceed with Cadastral Mapping
SHORT TERM GOALS
Compare Detailed Model with MTIS II and/or Other Models
Integrate All GIS Data Models and Databases
Integrate GIS with Corporate Systems and Data
LONG TERM GOALS

2.0 INTRODUCTION

2.1 Project Background

From September 1987 to December 1989, a number of both broad and narrowly focussed studies and projects were undertaken. These studies examined the feasibility, practicality and potential extent to which a Geographic Information System (GIS) could be used within the City of Scarborough. Data requirements, technology appropriateness, management requirements and staffing requirements were all examined.

In January 1990 funding was approved for the development and implementation of a Geographic Information System in the City of Scarborough. A Project Manager was assigned and a Strategic Planning Session was held with most key users. The stated mission of the entire G.I.S. effort was to create the best user-oriented and user-defined municipal geographic system in North America.

By April 1990, a high-level Conceptual Model had been developed to identify the City's GIS data requirements and to provide an overall plan for development and implementation of that GIS. This Conceptual Model identified twelve out of a total of thirteen corporate databases which would be important to GIS activities. Four of these databases were deemed to be GIS Databases. These four were called:

Base Map Database;
Cadastral Database;
Structures Database; and
Engineering Database.

Although nine databases were not designated as GIS databases, it was anticipated that users would frequently request an aggregation of GIS and non-GIS data to satisfy specific requests for information.

The four GIS databases were deemed to require the development of five distinct systems whose functions were to:

Manage Base Map;
Manage Cadastral Information;
Manage Engineered Infrastructure;
Manage Structures; and
Manage Data Conversion.

The Cadastral Information System was the first project in the proposed sequence for development.

2.2 Methodology

The City of Scarborough has adopted, as its standard for the development of information systems, use of the methodology "Productivity Plus" developed by the DMR Group and the Computer Assisted Software Engineering (CASE) tool EXECELERATOR. The Cadastral Database Study has followed this methodology, specifically dealing with the Preliminary Analysis Phase.

The Cadastral Database Project did not complete the Preliminary Analysis Phase in all its aspects. Instead, a detailed Conceptual Data-Entity Relationship Model was created, reviewed and then compared to the Conceptual Model for the Metro system, MTIS-II.

It was intended that a separate project would proceed further to the design of System Architecture should MTIS-II not prove to be a usable model for Scarborough or should complete evaluation of MTIS-II not be possible.

2.3 Project Context

Information on land is generally assigned to clearly defined parcels. Such a parcel is referred to as a Cadastre. A collection or database dealing with these parcels is described as a Cadastral database.

The City of Scarborough has embarked upon a four-year plan for the development and implementation of a City-wide Geographic Information System. A foundation for this development has been created and the overall effort divided into a number of projects. The Cadastral Database is one of these projects. It is an essential basis for, and a critical factor in, the work on subsequent projects within the total Conceptual Model.

The purpose of the Cadastral Database Study was to synthesize user wants and needs, in terms of data related to parcels of land, street network and administrative boundaries so that the subsequent evaluation, or development, of systems or applications is possible.

Considerable research into user requirements had already been completed. Information Resource Plans (IRP) had been developed for each department and for the Corporation as a whole. A Global Plan for CADD-GIS had been prepared and an independent Existing Data Set Study initiated. Individual departments and representatives of professional disciplines had also examined specific computer applications appropriate to their particular activities.

3.0 TERMS OF REFERENCE

3.1 Scope of Project

3.1.1 The scope of this project included the following:

.1 Compilation of all information previously collected on Cadastral user needs to create a list of data required;
.2 Definition of Entity Relationship Model(s) of Data Elements within the Cadastral Database and incorporating this into the Global Conceptual Model previously created;
.3 Review of the proposed Metropolitan Toronto Information System (MTIS-II), specifically comparing it to the City of Scarborough's Data Model, and evaluating the suitability of Metro's model to Scarborough's requirements; and,
.4 Recommendation of a strategy for the use of MTIS-II without alteration, the modification of MTIS-II to make it suitable for use, or the setting aside of MTIS-II and the creation of an independent Scarborough system.

3.1.2 The scope of the project excluded the following:

.1 System design for applications based on the database;
.2 Development of technical requirements or recommendations for hardware or software or the identification of technical alternatives;
.3 Development of cost/benefit analysis;
.4 Negotiations with Metropolitan Toronto for the modification of MTIS-II;
.5 Designing a Scarborough system should MTIS-II prove to be unacceptable; or,
.6 Production of Cadastral Mapping which would proceed independently as a separate, but related project with its own timetable.

3.1.3 The Project would be deemed successful were the following achievements to be met:

.1 A Cadastral Data Model is devised which would be sufficiently detailed to permit:

.1 Inclusion within the GIS Conceptual Data Model as an integral component;
.2 Clarification and/or direction to the Cadastral Mapping Project;
.3 Development of subsequent projects, particularly other GIS Data Models, which would be dependent upon the Cadastral Data Model; and,
.4 Evaluation of the MTIS-II Data Model vis-a-vis the requirements of the City of Scarborough.

.2 Metro Toronto Information System (MTIS-II) is evaluated and a recommendation made as to its usability by the City of Scarborough.

3.2 Study Method

This project comprised four distinct phases: Project Definition, Data Definition, Evaluation of MTIS-II and Report Preparation. The primary phase, Data Definition, made extensive use of the Preliminary Analysis component of Productivity Plus by DMR and the CASE tool EXECELERATOR.

3.2.1 Project Definition

This involved: preparation of the Project Statement; assembly of all relevant documents; preparation of space, equipment and schedules; assembly of Team Members; and preparation of overall, weekly and daily workload assignments for the Data Definition Phase. Work was done by the GIS Support Analyst and the Business Analyst.

3.2.2 Data Definition

This involved intensive daily sessions by a Team of users from several departments over a period of several weeks to produce Conceptual Data-Entity Relationship Models. These models were then reviewed by various selected City users, representatives of outside agencies, the City's System and Information Services staff and the GIS Group itself. Documentation was prepared and reviewed by the GIS Support Analyst, the Business Analyst and the System Analyst. The Project Team and participants in the evaluation sessions are described in Appendix One.

3.2.3 Evaluation of MTIS-II

This involved designing an evaluation method, comparing the City's Cadastral Model with Metro's Model, reviewing the results with Metro and Ministry of Natural Resources staff and preparing conclusions. Work was done by the GIS Support Analyst, the Business Analyst and the Systems Analyst.

3.2.4 Report Preparation

This involved preparation of a Preliminary Report by the Business Analyst and GIS Support Analyst. This report was presented to various outside agencies for comments, presented and circulated extensively within the City and finalized.

4.0 BUSINESS DEFINITION

The Cadastral Database will likely operate both as an integral component of the City's business activities and Corporate Business Model and as one of the sources of data for several specific applications.

4.1 Cadastral Database Users

Users of the Cadastral Database can be grouped into five categories:

4.1.1 Users internal to the City of Scarborough who are concerned with co-ordination of updates of the Cadastral databases:

.1 GIS Group
.2 Works Department, Surveys and Mapping Division
.3 Finance and Management Services Department

4.1.2 Users internal to the City of Scarborough who are responsible for the initial capture of Cadastral data and require information from several areas of the GIS as support for their specific administrative responsibilities:

.1 Works Department;
.2 Buildings Department;
.3 Planning Department;
.4 Recreation and Parks Department;
.5 Maintenance and Construction Department;
.6 Health Department
.7 Fire Department;
.8 Economic Development Department;
.9 Finance and Management Services Department;
.10 Library Board;
.11 Clerk's Department.
.12 Law Department;
.13 Personnel Department;
.14 City Council;

4.1.4 External users who provide and require information from GIS:

.1 Provincial Government, including:

.1 Ministry of Consumer and Commercial Relations (MCCR);
.2 Ministry of Revenue (MOR);
.3 Ministry of Natural Resources (MNR);
.4 Ministry of Municipal Affairs (MMA);
.5 Ministry of Government Services (MGS);
.5 Ministry of Health;
.6 Ministry of Education;
.7 Ontario Hydro;

.2 Federal Government, including:

.1 Statistics Canada;
.2 Health and Welfare Canada;

.3 Regional and Municipal Governments and agencies, including several individual departments of;

.1 Metropolitan Toronto;
.2 York Region;
.3 Durham Region;
.4 Town of Markham;
.5 City of North York;
.6 City of Toronto;
.7 Borough of East York;
.8 Town of Pickering.
.9 Metropolitan Toronto and Region Conservation Authority.
.10 Scarborough Board of Education
.11 Metro Toronto Separate School Board

.4 Public Agencies and Utility companies, including:

.1 Scarborough Public Utilities Commission;
.2 Bell Canada;
.3 Consumers Gas;
.4 Cable TV companies.

4.1.5 External users who require access to Scarborough GIS information, including:

.1 Scarborough residents, employers, and other members of the Public and Business communities;

.2 Private Sector business, including:

.1 Property developers;
.2 Consultants;
.3 Real Estate Companies.

4.2 Purposes to which the Data may be put:

4.2.1 It was not within the mandate of this Study to examine detailed Functionality. The data was, however, ultimately expected to be used by the groups listed above for several specific applications. The list of purposes below is not exclusive, nor is it to be interpreted as specification for further development:

.1 Custom Cadastral Map Production
.2 Custom Schematic Single-line Street Map Production
.3 Routing Design
.4 Recreation Facilities and Program Planning
.5 Parks Facilities Queries
.6 Property Status Queries (eg for Applications for Building Permits
.7 Logging various Inspection Reports
.8 Tracking Complaints or Enquiries
.9 Determining Development Potential
.10 Emergency or other Notification
.11 Demographic Analysis
.12 Land Survey Research
.13 Tax and Assessment Queries

5.0 DATA DEFINITION

The overall Conceptual Data Model divided the Cadastral Database into three sub-components, or Facets, entitled PARCEL, STREETNET and ADMINISTRATIVE BOUNDARIES. The Cadastral Database Study confirmed that these three Facets were indeed logical divisions. Each Facet was then sub-divided into Entities and the Entities further divided into non-exclusive lists of Attributes. All data would be stored in a format that could be superimposed onto the Base Map and Engineered Infrastructure as required.

Following are the Models and definitions of the Entities used in the Cadastral PARCEL Facet Conceptual Data Model, the Cadastral ADMINISTRATIVE BOUNDARIES Facet Conceptual Data Model and the Cadastral STREET NETWORK Facet Conceptual Data Model. For greater detail, please see Appendix Three where the Data definitions are followed by the respective Relationship Definitions and the detailed Definitions as well as Data-Entity Relationship Models indicating cardinality.

In the Conceptual Data Model these Facets are defined as follows:

Parcel: Data about the nature and extent of interests in land including address, ownership, assessment and extent of authority.

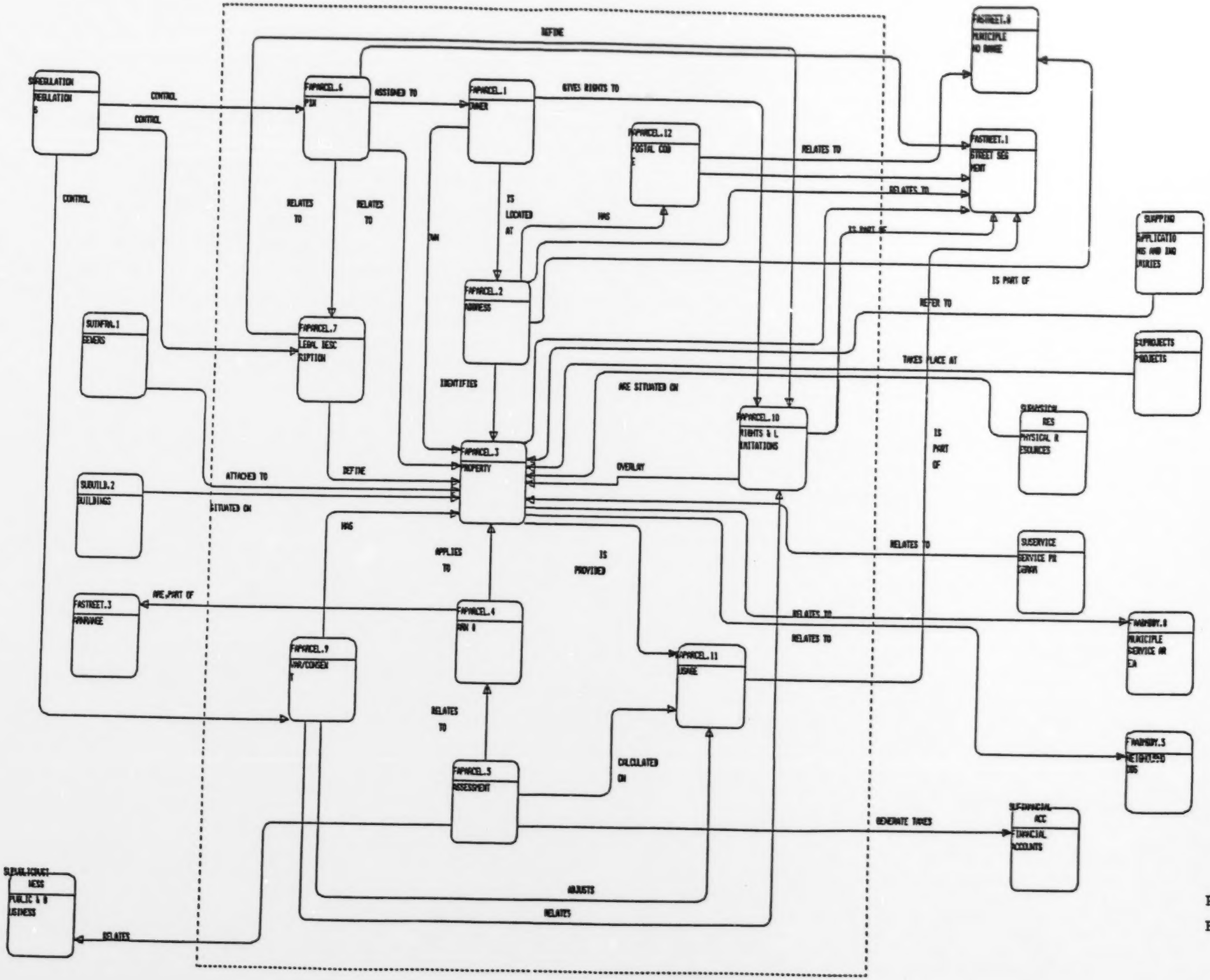
Street Network: Data about the road network, road segments and address ranges within the City. This would permit quick and consistent referencing and provides a linkage to the Engineered Infrastructure by means of the street segment name.

Administrative Boundaries: Data about the "official" extent of interest in land and administrative boundaries such as ward, health district and planning area.

The definitions listed below were agreed to as a result of the team effort described in Section 3.3.3 above. The reader should be cautioned that many individual and professional disciplines define specific words differently. The terms defined in this document represent a consensus and relate to their functions in the Model created for the Cadastral Database.

5.1 Parcel

5.1.1 Parcel Facet Data Model



PARCEL
FACET

5.1.2 Parcel Facet Descriptions

The entities of PARCEL Facet are as follows:

.1 Property
.2 Rights and Limitations
.3 Address
.4 Usage
.5 Legal Description
.6 Assessment Roll Number
.7 Assessment Data
.8 Property Identification Number
.9 Owner
.10 Variances and Consents
.11 Postal Code

These Entities are described below:

5.1.2.1 PROPERTY

Property is defined as a two dimensional polygon that is measured either directly or by mathematical computation with the facts needed for determining the boundaries, size, position, shape, etc.

5.1.2.2 RIGHTS & LIMITATIONS

Rights and Limitations are those agreements that pertain to any interest or claim on property.

5.1.2.3 ADDRESS

Address is an alphanumeric description containing street number, street name and location.

5.1.2.4 USAGE

Usage defines the use of property whether it be current usage, future usage or usage permitted by by-law.

5.1.2.5 LEGAL DESCRIPTION

Legal Description is the document description used by the Land Titles and/or Registry Offices to define a property or rights.

5.1.2.6 ASSESSMENT ROLL NUMBER

Assessment Roll Number is one that is generated by the Provincial Assessment Office, Ministry of Revenue of Ontario.

5.1.2.7 ASSESSMENT DATA

Assessment Data are valuations placed on a property and buildings for municipal or other taxation purposes.

5.1.2.8 PROPERTY IDENTIFICATION NUMBER (PIN)

Property Identification Number is the provincial one that is generated and maintained by the Ministry of Consumer and Commercial Relations under the POLARIS program.

5.1.2.9 OWNER

Owner is an individual or individuals that own property or rights to property.

5.1.2.10 VARIANCE & CONSENT

A Variance is a minor change to the existing bylaw for usage.

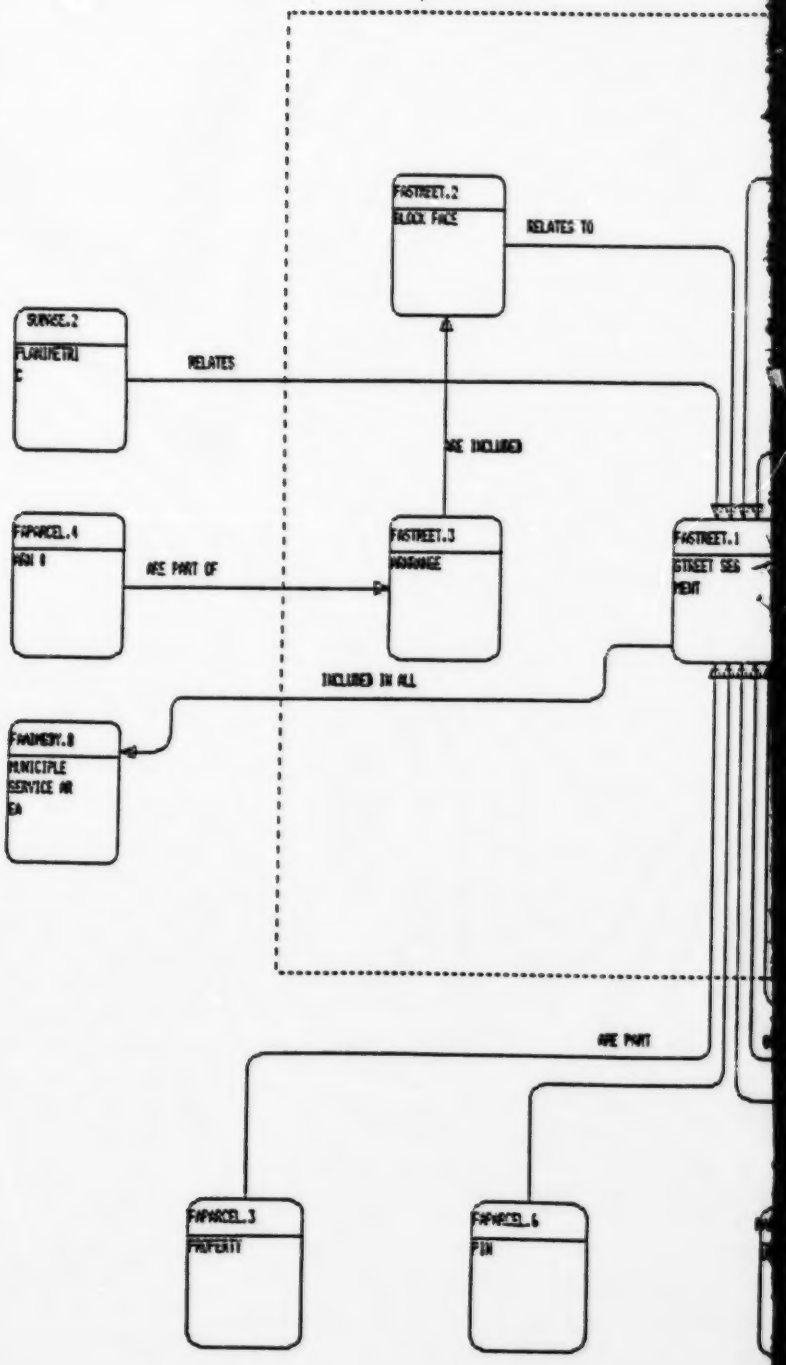
A Consent is a change to the shape and size of a property.

5.1.2.11 POSTAL CODE

Postal Code is a Canada Post designation.

5.2 Street Network

5.2.1 Street Network Facet Data Model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BLOCK FACE
RELATES TO
SURVCE..2
FLAMETRI
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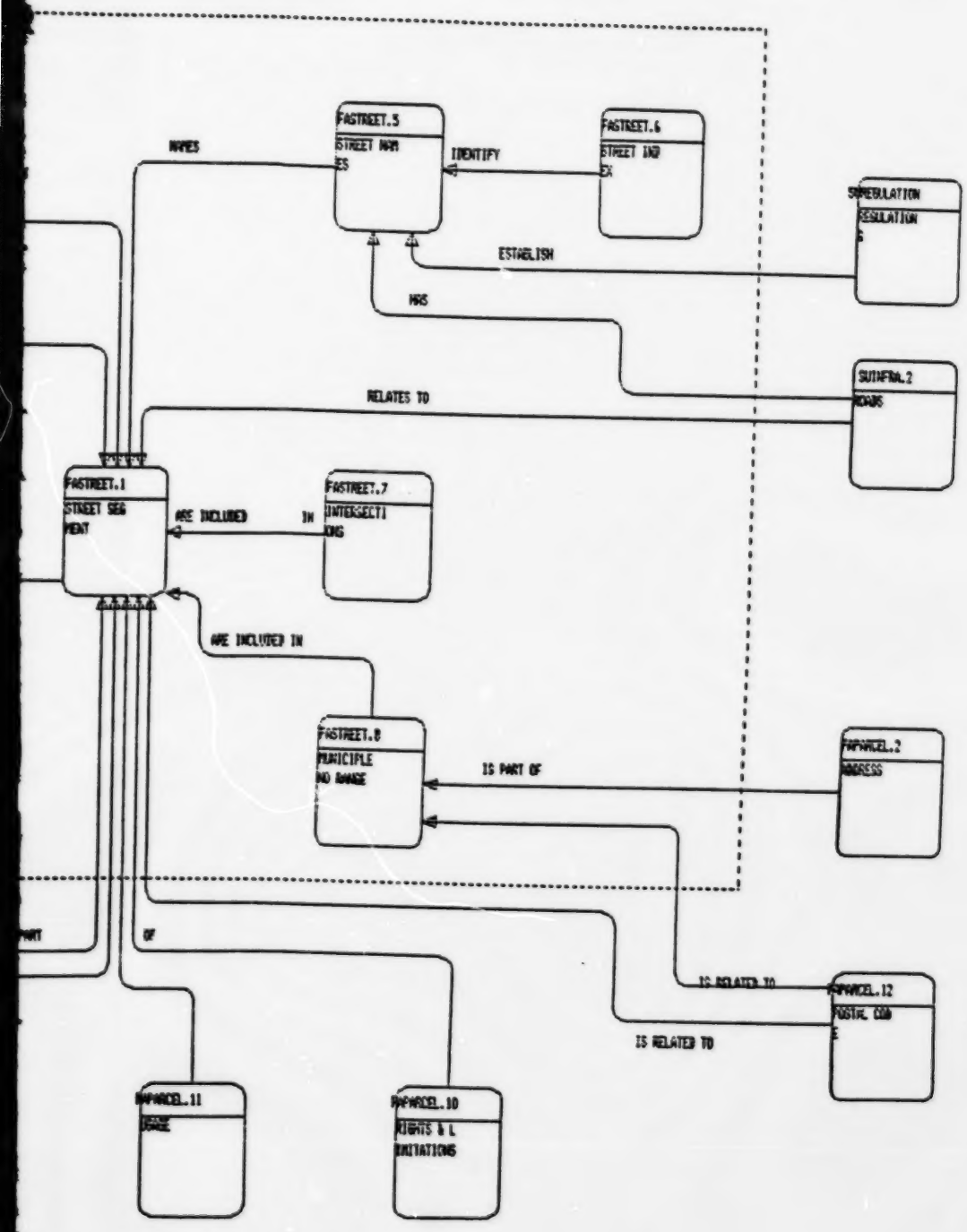
RELATES
ARE INCLUDED
FAPARCEL.4
ARE PART OF
FASTREET.3
FASTREET.1
INCLUDED IN ALL
FAADMSY.8
MUNICIPLE
SERVICE AR
EA
ARE PART
FAPARCEL.3
PROPERTY
FAPARCEL.6
PIN



STREET NETWORK
FACET

5.2.2 Street Network Facet Data Definitions

The entities of STREET NETWORK Facets are as follows:

.1 Street Segment
.2 Block Face Number
.3 Municipal Street Number Ranges
.4 Assessment Roll Number Ranges
.5 Street Intersections
.6 Street Index
.7 Street Names

These Entities are described below:

5.2.2.1 STREET SEGMENT

Street Segment is defined as point to point (eg intersection to intersection on one side of the street, or change in the character of a street, either side or both sides) or a postal code (point location), or a block face(Stats Can).

5.2.2.2 BLOCK FACE NUMBER

Block Face Number is defined as a federal government numerical identification of a specific street segment type.

5.2.2.3 MUNICIPAL STREET NUMBER RANGES

Municipal Street Number Ranges are ranges of low to high municipal street numbers designated by the City of Scarborough.

5.2.2.4 ASSESSMENT ROLL NUMBER RANGES

Assessment Roll Number Ranges are ranges of low to high assessment roll numbers designated by the provincial assessment office.

5.2.2.5 STREET INTERSECTIONS

Street Intersections contains the locations of all streets that meet at an intersection.

5.2.2.6 STREET INDEX

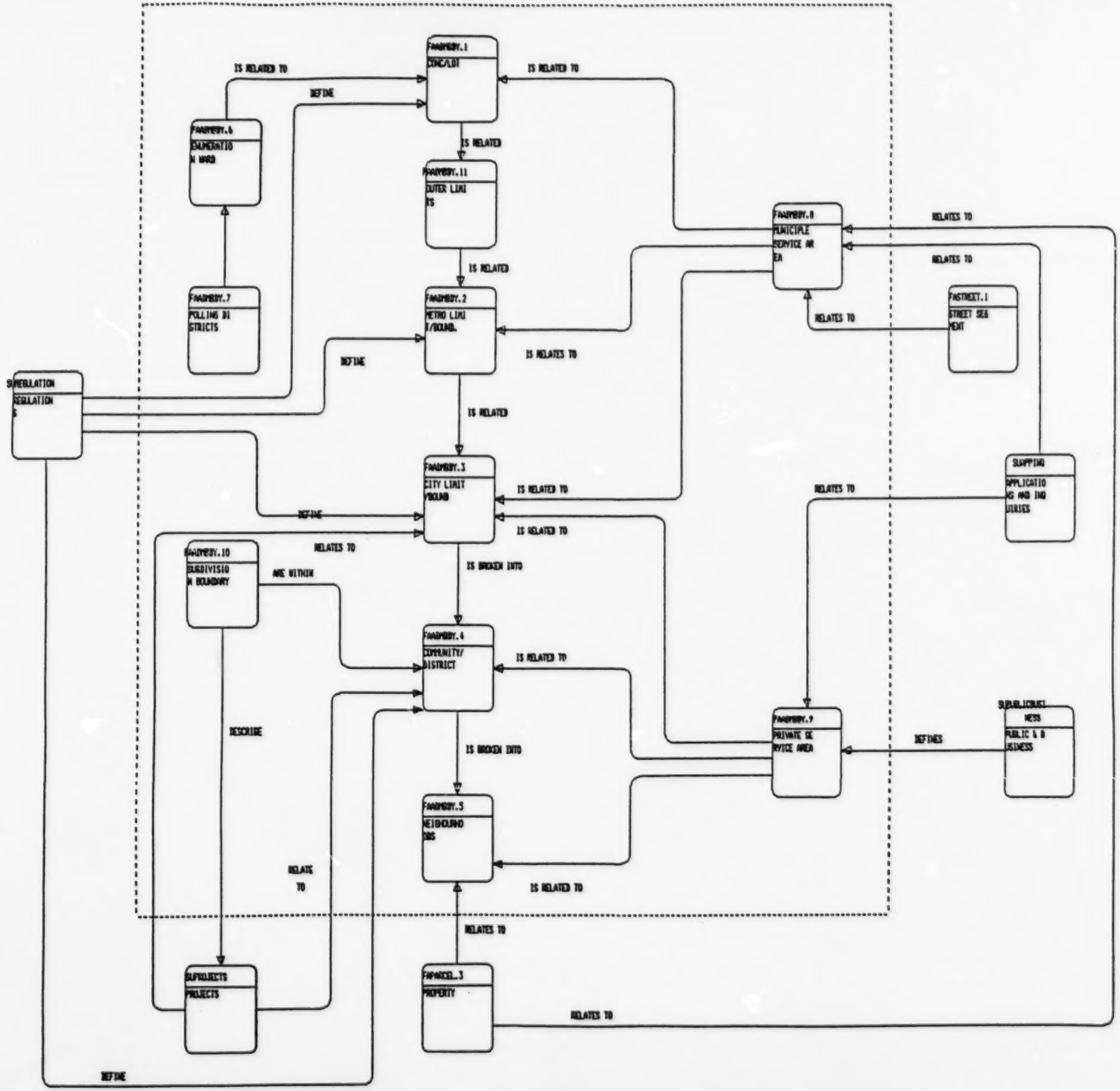
Street Index is a field that contains an unique code for each street in Scarborough.

5.2.2.7 STREET NAMES

Street Names contains the description of the street index code.

5.3 Administrative Boundaries

5.3.1 Administrative Boundary Facet Data Model



ADMINISTRATIVE
BOUNDARIES FACET

5.3.2 The entities of ADMINISTRATIVE BOUNDARIES Facets are as follows:

.1 Concession,Lot
.2 Enumeration Wards
.3 Polling Districts
.4 Municipal Service Areas
.5 Private Service Areas
.6 Outer Limits and Boundaries
.7 Metro Limits and Boundaries
.8 Scarborough Limits and Boundaries
.9 Community and District Boundaries
.10 Neighbourhoods
.11 Subdivision Boundaries

These Entities are described below:

5.3.2.1 CONCESSION,LOT

Concession,Lot is the description of all property as per original Township (Crown) fabric.

5.3.2.2 ENUMERATION WARDS

Enumeration Wards are those that are created by all levels of government: municipal, regional, provincial or federal.

5.3.2.3 POLLING DISTRICTS

Polling Districts are those that make up enumeration wards as created by all levels of government.

5.3.2.4 MUNICIPAL SERVICE AREAS

Municipal Service Areas are those specifically designed for each type of City Service (eg. Health, Fire, Library, Recreation & Parks, Schools).

5.3.2.5 PRIVATE SERVICE AREAS

Private Service Areas are those that are created by private citizens and community groups.

5.3.2.6 OUTER LIMITS AND BOUNDARIES

Outer Limits and Boundaries are the boundaries to municipal lands adjacent to Metropolitan Toronto and the limits to areas of common designation within the Official Plan for the Greater Toronto Area.

5.3.2.5 METRO LIMITS AND BOUNDARIES

Metro Limits and Boundaries are the outer boundaries and large, internal divisions of Metropolitan Toronto and the limits to areas of common designation within the Metro Official Plan.

5.3.2.5 SCARBOROUGH LIMITS AND BOUNDARIES

Scarborough Limits and Boundaries are the outer boundaries of Scarborough within the greater Metro Toronto area and the limits to areas of common designation within the Scarborough Official Plan.

5.3.2.5 COMMUNITY AND DISTRICT LIMITS AND BOUNDARIES

Community and District Boundaries are those boundaries defined by Municipal By-Law for Planning purposes including Secondary Plans, Zoning, etc. and the limits to areas of common designation such as Environmental Impact Zones, Official Plan designations, Zoning Restrictions, etc.

5.3.2.5 NEIGHBOURHOODS

Neighbourhoods are wholly within Communities and, when combined, create the respective Community Boundary.

5.3.2.5 SUBDIVISION BOUNDARIES

Subdivision Boundaries are those that show the outer boundaries of each subdivision as defined by the Planning Act.

6.0 EVALUATION OF MTIS-II

6.1 Evaluation Method

The criteria used for the evaluation and comparison of the City of Scarborough's Cadastral Facet Models and the Metro Toronto Information System - II (MTIS-II) Data Entity Relationship Model are as follows:

6.1.1 Definition: Each entity/element should have the same meaning and intent.

6.1.2 Relationships: Each entity/element should have the same type of relationships.

6.1.3 Create/Maintain: Each entity/element should be similarly created/maintained.

6.1.4 Lengths: Each entity/element should have similar lengths.

6.1.5 Attributes: Each entity/element should have a similar number of attributes.

Also included in the evaluation is the comparison of the following 3 sections:

CADASTRAL	MTIS-II
Subject Data Bases	Levels
Facet Entities	Data Entities
Entity Elements	Data Attributes

6.2 Metro Toronto Information System - II

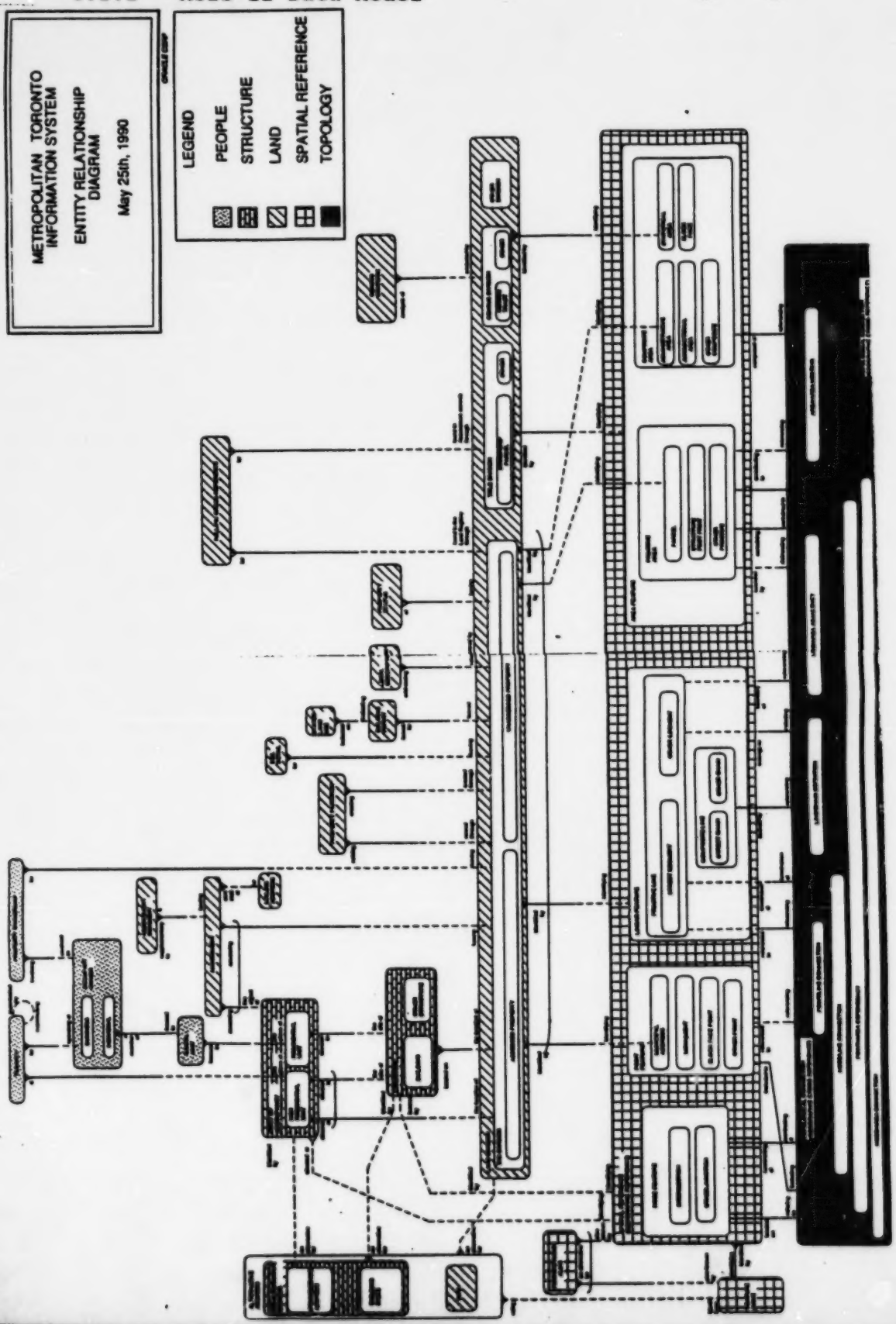
6.2.1 Description:

Metro Toronto Geosystems (formerly Central Mapping Agency) has conceptually designed a Metro-wide inter-municipal Geographic Information System to allow members of the Metro Federation access to common spatial land base within the Metropolitan Region.

The conceptual data-entity model was produced using ORACLE Case software products. The data entity model depicts six entity levels, and within each level, entities and their attributes are described in ORACLE produced documentation.

For greater detail, please see Appendix Two.

6.2.2 MTIS-II Data Model



6.3 Evaluation

6.3.1 Levels:

.1 The Cadastral Database is one of 13 Corporate Subject Databases with 3 Facets - Parcel, Street Network, and Administrative Boundaries.

.2 The MTIS-II Data Model is one Database with 6 levels - Topology, Spatial Reference, Land, Structure, People, and Things/Objects.

6.3.2 Entities:

The following list shows the entities for both Cadastral and MTIS-II models. The Cadastral model can handle Rights & Limitations, Variances & Consents and Property Entities at many different levels; whereas, in the MTIS-II model, an optional "OTHER" space has been left for future expansion apart from the current assessment level. The MTIS-II model has additional entities such as Structures, Buildings, Tenancy, Social Unit, Soil Detail, Census Statistics, Unit of Occupancy, etc.

Cadastral	MTIS-II
Property	Parcel Property Partition Property Status Assessed Property Unassessed Property
Address	Mailing Address Municipal Address Convenience Address
Owner	Property Ownership Ownership Parcel Occupant/Owner
Legal Description	Legal Description
Property Identification No.	Roll/PIN Cross-reference
Postal Code	Other-Census Divisions Statistical Area
Rights & Limitations	Other-Title Division Other-Primitive

Cadastral	MTIS-II
Assessment Roll No.	Roll/PIN Cross-reference
Assessment Data	Assessment Assessment Comment
Variance & Consents Usage	Other-Title Division Stated Land Use
Block Face	Block Face Block Face Point Statistical Area
Street Names	Feature Names Feature Name Alias
Street Index	Feature Names
Street Segment	Street Segment Street Chain Other Chain Other Segment
Street Intersections	Intersection Other Junction
Municipal No. Range	Block Face Street Segment Street Chain
Assessment No. Range	Roll/PIN Cross Refr
Concession/Lot	Jurisdictional Area
Outer Limits	Jurisdictional Area
Metro Limits & Boundaries	Jurisdictional Area
City Limits & Boundaries	Jurisdictional Area
Community/Districts	Jurisdictional Area
Neighbourhoods	Jurisdictional Area
Enumeration Wards	Jurisdictional Area
Polling Districts	Jurisdictional Area
Subdivision Boundaries	Jurisdictional Area

Cadastral	MTIS-II
Municipal Service Area	Administrative Area
Private Service Area	Other Composite Area
	Monument
	Other Point
	Census Statistics
	Soil Detail
	Tenancy
	Social Unit
	Unit of Occupancy
	Structures
	Buildings
	Building Names
	Assessment Areas

6.3.3 Elements:

The element lists for Cadastral were produced using EXCELERATOR software while the MTIS-II documentation was created via ORACLE Case software.

.1 Spatial Data:

Basically, the MTIS-II model can accommodate the street network, administrative boundaries and parcel spatial elements through node, point, linear, and area features.

However, the Cadastral model street network is based upon complete property fabric with optional types of centre-lines (centre of road allowance, centre of payment, centre of construction, etc.). The MTIS-II model, at this time, defines the street network as a single centre line of the road with no fabric.

.2 Tabular Data:

.1 The Cadastral model has elements that have several occurrences. For instance, Property can have four different types of dimensions - intent, survey, assessment, and rights & limitations.

.2 The MTIS-II Model is based upon assessment only; although, it has been pointed out that there are "OTHER" entities where these needs could be included.

.3 Other Cadastral entities/elements such as multiple addresses, rights & limitations, variances & consents are also multi-level which are not currently defined in the MTIS-II model.

.4 The Cadastral model identifies assessment data as residential, commercial, and business; whereas, in MTIS-II, assessment data is stored as Realty and Business. It appears to be the same data but separated differently.

.5 Most of the data that Scarborough uses is property based with special municipal accumulations. Initially, MTIS-II data is used for Metro and Municipal Planning Applications. The elements seem to be similar in format but some will not always be the same, either an aggregated total as opposed to individual data or different types of accumulated totals.

.6 MTIS-II has assessed and unassessed property, but the Cadastral identifies all property as assessed.

.7 The MTIS-II model has additional data such as Census Statistics, Social Units, Building and Structures data.

.3 Relationships:

In the MTIS-II model, the assessment roll number and the property identification number are directly related to each other in a table. In the Cadastral model, the assessment roll number and the property identification number are related through property.

.4 Other Comments:

The City of Scarborough's Cadastral Data was developed using Corporate and Departmental Business functions defined from Information Resource Plans. MTIS-II data was developed using Ministry of Revenue's Assessment Data, Stats Canada Census Statistics and Metro Planning demographic data.

Both models contain the same words but some may have different implied meanings.

7.0 CONCLUSIONS

7.1 Comparison to MTIS-II

The comparison of Cadastral Database to MTIS-II has led to the following conclusions:

.1 The Business Objectives of Metro and Scarborough are different;
.2 Scarborough's Cadastral Database Model meets Scarborough's needs;
.3 Metro's MTIS-II meets Metropolitan Toronto's needs;
.4 Some Data Elements are different between the two Models;
.5 Some Applications to which the two systems would be put are different;
.6 Functional Data and Process Requirements must be examined before making any further decisions; and,
.7 The Current Status of development of each system is different.

These points are described below:

7.1.1 Business Objectives:

Metropolitan Toronto's operational activities are different from those of individual municipalities. Municipalities such as Scarborough collect garbage, fight fires, operate health clinics and run recreation programmes. The municipal roads being maintained are far more extensive in total number and in complexity than the Metro road system. The same would be true about sewers, parks and Official Plan designations. Scarborough collects taxes and issues building permits while Metro does not. The data used in Metro's GIS, therefore, tends to be assembled and stored for different reasons than Scarborough's data.

Scarborough's Cadastral Model indicates the use of some data, notably Assessment Information, which both Metro and Scarborough use for G.I.S. research and analysis purposes. In Scarborough this data is also a critical component of the City's business operations for use in, for example, the collection of taxes. Assessment data is available to both parties from the Ontario Ministry of Revenue but Scarborough verifies and then uses the periodic updates received to keep current its own tax records whereas Metro would be satisfied to use the provincial data.

7.1.2 Scarborough's Cadastral Database Model:

The Cadastral Database Conceptual Models illustrated in Section 5 of this Report represent the business needs of the City of Scarborough for both detailed and aggregated data about individual properties. As Conceptual Data Models this has been verified through discussions with user representatives from several departments within the City.

7.1.3 Metro's MTIS-II:

Metro's Model, MTIS-II, as interpreted by this study, is specifically geared to GIS activities and will be a system complete with Hardware, Software, Standards, Data and Data Maintenance capability. It is not an active component of the business operations of Metropolitan Toronto but is intended primarily as a research and analysis tool. Copies of the data, such as that given to Metro Ambulance, would be used in local business activities such as emergency dispatch. In view of the overall principle of co-operation among the various participants in the Metro Federation, space is deliberately made for storage of elements unique to individual users, or, as yet, unknown.

7.1.4 Data Elements:

Despite the different business objectives behind the requirements for GIS at both the Metro and Scarborough levels, the evaluation in Section 6 determined that most Data elements to be stored are very similar. Significant discrepancies include the following:

.1 Non-GIS Data Elements

Some Data Elements, such as those related to household composition or building details, are maintained by Metro in MTIS-II whereas Scarborough anticipated placing these elements in completely separate databases, some of which would not even be considered G.I.S. databases, with ties to the Cadastral Database.

.2 Cadastral Mapping

Metro does not now store actual Cadastral Survey information defining individual parcels and streets. This is an integral component of Scarborough's Conceptual Design. It is anticipated that use of a single line street network, as proposed by Metro, may not necessarily remain compatible with true Cadastral Mapping.

.3 Rights and Limitations

The ownership of Rights and Limitations, such as easements, is not identified in the Metro Model although it should be possible to incorporate this with little difficulty.

.4 PIN vs Assessment Roll Number

The MTIS-II Model includes a table relating POLARIS PIN to Assessment Roll Numbers while Scarborough's Model treats all property identifiers completely independently. The experience of the City of Scarborough and other Ontario municipalities such as the Regional Municipality of Oxford County is that the relationship between PIN and Assessment Roll Number may not be direct or desirable and may be difficult to maintain.

.5 Aggregated Data

Scarborough stores some aggregated information for more efficient day-to-day activities while Metro would prefer to store data at the most primitive level possible for aggregation as required.

7.1.5 Applications:

The most significant variation in the anticipated use of Cadastral Database data is network analysis. MTIS-II suggests that any schematic use of data, such as sewer analysis and management or transportation modeling is a direct application of this system while the physical description and actual positioning of such items as sewers or roads is part of a Base Map.

Although this parallels the City's thoughts that Infrastructure Mapping is part of a Base Map and that Infrastructure Management is part of a Network System, no specific Models have yet been completed. Similarly, MTIS-II is expected to relate to a minimal topographic background map (suitable for display at a scale of 1:10,000) which would be maintained independently of the primary Base Map (suitable for display at a scale of 1:500). The City itself has not yet decided on the ideal standards for large-scale or medium-scale mapping, although it has been suggested that more than one topographic map may be an unacceptable redundancy.

7.1.6 Functional Requirements:

The concerns about applying MTIS-II to the City of Scarborough's requirements do not relate to the Conceptual Data Model per se, but to the definition of other relationships. Greater detail is required about the intended data-sharing relationship between Scarborough and Metro and data-sharing between Scarborough's Cadastral Database and other, as yet undeveloped, GIS applications within the City's organization.

7.1.7 Current Status:

MTIS-II was specifically created by Metro Geosystems in cooperation with consultants, vendors, in-house staff and some user representatives. It is now, after many years of development, in the first stages of system construction and a Request for Proposals is now being prepared by Metro for the acquisition of Metro's hardware. Baring unexpected problems, MTIS-II should be available, complete with single-line street network, data and background topographic mapping, for use in early 1991 by users with appropriate equipment. Initially all data would be located centrally and users would log-on to the Metro system from their remote locations. Various Metro departments, particularly Metro Planning, Metro Police and Metro Ambulance will use the system immediately. Other Metro Departments and Area Municipality Planning Departments are expected to gradually begin using the system through 1991, developing user applications as required.

7.2 Courses of Action

The number of possible alternative courses of action, which are not mutually exclusive, are as follows:

.1 Adapting Scarborough's business activities to suit the requirements of MTIS-II;

.2 Adapting MTIS-II to suit the business requirements of Scarborough and then incorporating MTIS-II as the City's Cadastral database;

.3 Developing detailed Scarborough Functional and Physical Data and Process Models of the Cadastral Database;

.4 Developing prototype user application(s) for MTIS-II (eg Planning-type demographic queries);

.5 Completing the modeling activities for the other Scarborough GIS databases; and,

.6 Analyzing other, existing municipal GIS systems with a view to possible acquisition and modification.

These are described in greater detail below:

7.2.1 Adapting Scarborough's business activities to suit the requirements of MTIS-II:

.1 This would involve extensive technical examination of MTIS-II in order to restructure existing and anticipated City data to MTIS-II format and establishing the hardware and software necessary to use. This would likely require six to ten City technical staff approximately 6 months.

.2 This is unlikely to be a practical solution as MTIS-II was not designed to fulfill corporate business functions;

7.2.2 Adapting MTIS-II to suit the business requirements of Scarborough and then incorporating MTIS-II as the City's Cadastral Database:

.1 The relationship between Scarborough and Metro could best be examined by creating a working task force of both Metro and City technical staff which would jointly review the Cadastral Database conceptual model, develop a preliminary Functional Model and Physical Model which would meet Scarborough's needs and then modifying MTIS-II to accommodate this model. This could also establish some hardware and software standards as well as the method of data transfer between Scarborough and Metro. It is anticipated that this would require approximately three City staff for a period of five to six weeks. Metro has no objections to this approach although this is subject to the availability of appropriate Metro staff.

.2 This technical examination is essential to establish whether MTIS-II could fulfill Scarborough's long term needs for GIS.

7.2.3 Developing a detailed Scarborough Functional and Physical Model:

.1 This could lead to a prototype capable of demonstrating specific functions for either a limited geographic area or a limited range of data (eg responding to queries at the Buildings Department counter). This would require approximately eight weeks to define by a team of 3 staff and four months to assemble and store Cadastral data for a prototype. To develop a full-blown system would most likely require as much, if not more, time than was required to produce MTIS-II.

.2 This approach is necessary to understand the level of complexity which would be required of a made-in-Scarborough solution. It would also have the advantage of creating a demonstration system which could exhibit typical functionality if not final design. It would also be used as a comparative means of evaluating commercial or other custom-built GIS solutions for the City of Scarborough;

7.2.4 Developing prototype user application(s) for MTIS-II (eg Planning-type demographic queries):

.1 This would involve no direct involvement in the modification of MTIS-II until its release, learning to operate the system, defining the scope of the application(s) desired, acquiring compatible hardware and software, writing the specific application(s), training user staff and operating and monitoring the application in much the same manner as a prototype. A suitable prototype application would likely require approximately three weeks work by three City staff following release of MTIS-II plus appropriate training by the vendor and/or by Metro of Scarborough staff.

.2 This approach would involve only the outlay of financial resources to cover user training and could still demonstrate both general GIS functionality and the applicability of the specific MTIS-II model to Scarborough's environment. These application could be used for demonstration purposes, could provide true GIS service for specific users such as Planning Department on a permanent or interim basis and to develop the expertise useful in evaluating other systems;

7.2.5 Completing the modeling activities for the other Scarborough GIS Database:

.1 This would involve halting further investigation into or development of the Cadastral Database. The Infrastructure Management Database, Base Map Database and Structures Database would be modelled and carefully examined with a view to integration with the Cadastral Database and/or comparison with MTIS-II.

.2 This approach would permit the maximum integration and the minimum redundancy of data for Scarborough. It is the classic approach to system design. It would defer the completion of any interim functionality for a period of up to several years but would likely save some unnecessary development efforts and costs; and,

7.2.6 Analyzing other, existing municipal GIS systems such as that of Oxford County with a view to possible acquisition and modification:

.1 This would involve comparing Data Models, developing a Preliminary Functional Model and either rejecting or accepting for physical testing the specific software developed at the subject site. Suitable hardware would have to be acquired and a Pilot Project defined. This would require approximately 5 City staff six to eight weeks.

Course of Action Summary Chart

	Course	Scar Staff	Time (months)
1	Adapt Scar Business Functions to MTIS-II	10	6
2	Adapt MTIS-II to Scarb Business Function	3	2
3	Complete Cadastral Database	3	4
4	Prototype using MTIS-II	3	1
5	Complete GIS Databases	2	12
6	Analyze Municipal GIS Systems	5	2

8.0 RECOMMENDATIONS

It is recommended that two approaches be taken to achieve some long term and some short term objectives. Several different projects or activities are hereby recommended for each approach. All projects are expected to proceed simultaneously.

8.1 Short Term Actions

Short Term activities (ending approximately May, 1991) can provide true GIS service, user exposure and experience as well as clarification of user needs and expectations.

8.1.1 Use Unmodified MTIS-II

.1 Planning Department, Health Department, Recreation and Parks Department, Personnel Department, Economic Development, Scarborough Board of Education and Scarborough Library Board could each use the data and some functionality available in MTIS-II upon release.

.2 Hardware and software would have to be acquired, support staff trained, user applications written and an access procedure established. Actual user interface is designed to be relatively simple with little user training required.

8.1.2 Acquire Existing Systems other than MTIS-II

.1 Define and implement a Pilot Project for Buildings Department capable of responding to general queries of either a limited range or for a limited geographic area.

.2 The scope of the Pilot Project would have to be defined, specific software selected and modified, hardware acquired, data collected and support staff and users trained.

8.1.3 Continue Cadastral Database Modeling

.1 Functional Data and Process Models and Preliminary Physical Models would be developed for the Cadastral Database for use in more detailed examination of MTIS-II, for integration with other Scarborough Databases and to created a basis for the evaluation of potential hardware and software solutions.

.2 A project team would have to be assembled, the project scope defined and work proceed in conjunction with the modeling of other City databases.

8.1.4 Proceed with Cadastral Mapping

.1 Cadastral Mapping, especially in cooperation with agencies responsible for the definition of property (e.g. Provincial Ministries such as MCCR and MOR) must be completed before Scarborough can implement full Cadastral Database Functionality.

.2 The Project Team responsible for mapping should work closely with those responsible for the database. The Cadastral Mapping Project Statement should include Conceptual Modeling and Data Definition. Comparisons should be done to answer long-term compatibility with the Cadastral Database. The Cadastral Mapping Database should be treated as an integral component of the Cadastral Database and not as separate components.

8.2 Long Term Actions

Long term activities (ending approximately July, 1992) would result in the permanent Cadastral aspect of a fully integrated geographic information system for the City of Scarborough.

8.2.1. Compare Detailed Cadastral Model to MTIS-II and/or other GIS systems

.1 The Functional Model and Preliminary Physical Model developed in the Short Term Actions noted above would be compared to the detailed models of other systems. As well, the practical experience of users and support staff working with both MTIS-II and other system(s) in Pilot Projects would be applied directly in the assessment of permanent solutions to the City's Cadastral needs.

.2 Should the comparison result in the recommendation to proceed with permanent installation of either MTIS-II or another system, a team would be assembled to modify the selected system as appropriate.

8.2.2. Integrate all GIS Data Models/Databases

.1 By the end of the short-term period, all GIS Database Conceptual and preliminary Functional Models should be complete. Before proceeding with permanent system development and/or acquisition overall integration of all GIS databases would proceed.

.2 A Project Team would have to be assembled, a project scope defined and work proceed in conjunction with overall City Information Systems design and development.

8.0 Recommendations continued

8.2.3. Integrate GIS with Corporate Systems and Data

.1 By the end of the short-term period, the City's corporate information needs and long range plans will have proceeded to the stage whereby major hardware and software decisions would be required. The Cadastral Database may be an integral component of the City's business activities rather than an isolated, redundant data set. Knowledge gained from the Functional and Preliminary Physical Models as well as practical user experience would allow educated decisions on the integration of GIS, particularly the Cadastral Database, with corporate system.

2. A Project Team would have to be assembled, a project scope defined and work proceed in conjunction with overall City Information Systems design and development.

APPENDIX ONE

(NOT INCLUDED IN ALL ISSUES)

APPENDIX ONE
LIST OF USERS CONSULTED

Active Participants in Intensive Sessions

Graham Bloom, Information Systems
Raphael Sussman, GIS Group
Brian Pilkington, Works Department
Frank Weinstock, Buildings Department
Bill Hutz, Buildings Department
Carl Januszcak, Planning Department

Participants in Special Review Sessions

Valerie Higgin, Metro Geosystems
Ralph Smith, Metro Geosystems
Lazlo Sugar, Metro Geosystems
Bryan Tuckey, City of North York Planning Department
Marcia Baynthon, City of Burlington Information Services
Barry Costello, Ministry of Natural Resources

Carol Smith, Personnel
Paul Higgins, Health
Mel Bennet, Finance
Chris Hull, Planning
Ann Rexe, Planning
Peter Moore, Planning
Anna Bates, Economic Development
Dave Churchmuch, Works
Robert Gaspirc, Works
Geoff Bannon, GIS Group
Stan Walton, Recreation and Parks
Kingsley Ing, Board of Education
Michelle Topa, Library Board
Marcus Wiseman, Library Board
Alwyn Lawrence, SPUC Hydro
Brian Doherty, SPUC Water

Systems and Information Services Review Session (June 21, 1990)

Peter Rohe, Director, Systems
Keith deGruyther, Manager, Systems
Michael Ho, Systems
K.C. Huang, Systems
Ken Metric, Systems
Patrick McDade, Information Services
Greg Hodgins, Information Services

Works Department Review Session (June 25, 1990)

Tom Galley, Director Administration
Gary Welsh, Director Transportation and Planning
Stew Medley, Director Survey and Mapping
Tom McMullen, Director Design and Construction
Walter Elliott, Director Development Engineering
Dave Moy, Director Sanitation
Bob Quin, Waste Water Management
Jack Smith, Director Street Operations
Brad Wilson, Senior Engineer Street Operations

Scarborough Board of Education Participants (June 20, 1990)

John Anderson, Associate Superintendent, Planning and Operations
Peter Sidorchuk, Superintendent, Planning and Operations
Kingsley Ing, School Planner, Planning and Operations
Jack Haydock, Site Engineer, Plant Department
Lorna Earl, Research Director, Program Department
Geof McMacken, Administrative Assistant, Planning and Operations
Bob Kerr, Assistant Suuperintendent, Planning and Operations
Dale Peever, Supervisor, School Support Review

GIS Management Committee Participants (July 18, 1990)

Mike Price. Chairman
Stu Medly, Works Department
Lorne Ross, Planning
Frank Pastor, Maintenance and Construction Department
Liane McKenna, Recreation and Parks Department
Bernie Roth, Buildings Department
Peter Rohe, Systems
Alan Buist, Information Services

Buildings Department Review Session (July 19, 1990)

Jack Barron,
Andrew Zdanowicz,
C. Smith,
Galina Veltman,
A.D. Huber,
Frank Weinstock,
Don Mitton,

Economic Development/Clerks Department (July 20, 1990)

Al Greenway, Economic Development
Anna Bates, Economic Development
Frank Edwards, Clerk's Department
Dave Hawkins, Resource Centre

APPENDIX TWO

(NOT INCLUDED IN ALL ISSUES)

APPENDIX THREE

(NOT INCLUDED IN ALL ISSUES)